CITY OF HOUSTON

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May 8, 2015

Subject: Letter of Clarification No. 6 to Invitation to Bid No. S12-N25242 to Furnish and Deliver Various Types and Sizes of Pumps for the Department of Public Works and Engineering

To: All Prospective Bidders:

This letter of Clarification is being issued for the following reasons:

- **To revise the above referenced solicitation as follows:**

    1. **Replace bid document Technical Specifications Part B-III pages, with the revised pages marked, "REVISED 05/08/15", as applicable to Bid Item Nos. 23 thru 25 (Chicago Yeoman), 26 (PACO) and 33 thru 36 (Vaughan).**

When issued, Letter(s) of Clarification shall automatically become a part of the solicitation documents and shall supersede any previous specification(s) and/or provision(s) in conflict with the Letter(s) of Clarification. All revisions, responses, and answers incorporated into the Letter(s) of Clarification are collaboratively from both the Strategic Purchasing Division and the applicable City Department(s). It is the responsibility of the bidder/respondent to ensure that it has obtained all such letter(s). By submitting a bid on this project, bidders/respondents shall be deemed to have received all Letter(s) of Clarification and to have incorporated them into this solicitation and resulting bid.

Furthermore, it is the responsibility of each Contractor to obtain any previous Letter of Clarification associated with this solicitation.

Martin L. King

Martin L. King
Senior Staff Analyst
832-393-8705

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23.0 **LINE ITEM NO. 23 PUMP , HEAVY DUTY SOLIDS HANDLINGT**
Make: Chicago Yeoman Series 2111
Model: No.VPM-OLC-10 or City Approved Equal

23.1 **SUMMARY OF REQUIREMENT:**

23.1.1. Furnish and install four (4) Vertical Pedestal Mounted Pumping Units complete with all accessories and appurtenances as shown in the plans and specified herein or as required for a complete operating system. Each Pumping Unit shall be rated for continuous duty in accordance with the operating conditions defined in Table 1 of these specifications. Each unit shall be furnished with pump, pump support pedestal, suction elbow, motor pedestal, flexible coupling & guard. Each Pumping Unit shall be rated for continuous duty in accordance with the following operating conditions: 3,125 GPM, 30' Head, 870 RPM. The pump discharge is 10" in diameter.

23.2 QUALITY ASSURANCE

23.2.1. Pumps are to be engineered and manufactured under a written Quality Assurance program certified to the ISO 9001:2000 Quality System Standard. The Quality Assurance program is to have been in effect for at least five (5) years and shall include a written record of periodic internal and external audits to confirm compliance with ISO 9001:2000 requirements.

23.3 QUALITY CONTROL

23.3.1. The pumps shall conform to all applicable requirements of ASTM, ANSI and Hydraulic Institute. For purposes of this specification, the revision and/or version of the referenced standards in effect on the date of public bid opening shall apply.

23.3.2. The specified pumps shall be the products of reputable manufacturers who have been regularly engaged in the design, manufacture and furnishing of wastewater pumping equipment for at least ten (10) years. The manufacturer of the pump shall assume full responsibility for compatibility of the supplied components with the application.

23.4 PUMP CONSTRUCTION

23.4.1. Pumps shall be solids-handling type and each shall be complete with accessories as follows:

23.4.2. The pump casing, bearing housing, pump pedestal, floor plate, packing housing, suction cover and casing cover shall be manufactured of close-grained ASTM A-48, Class 30 cast iron. A suction elbow shall be provided with a hand-hole. A second hand-hole shall be provided in the pump casing.

23.4.3. The impeller shall be manufactured of close-grained ASTM A-48, Class 30 cast iron and dynamically balanced. The impeller shall be of the two-part closed design capable of passing a three inch sphere.

23.4.4. The pump shaft shall be machined from high grade alloy steel.

23.4.5. A large packing box shall be bolted to the pump casing. The packing box shall be provided with not less than five rings of graphite impregnated braided acrylic packing, a water seal ring and tapped connections so that seal water from an outside source or grease lubrication sealing may be provided. The pump shaft shall be protected from wear at the packing box by a slip-on type stainless steel sleeve.

23.4.6. The pump shall have two sets of deep-grooved single-row ball bearings designed for both radial and thrust loads. The bearings shall be mounted in a dust and moisture proof housing that is bolted to the pump casing to insure permanent alignment. Alemite fittings shall be furnished at each ball bearing for grease lubrication.

23.4.7. Pumps and supports shall receive one coat of an environmentally safe machinery enamel coating with a high solids content.

23.4.8. A motor support pedestal shall be bolted to the pump casings. The electric motor shall be directly connected by flexible coupling to the pump shaft

23.5 TESTING

23.5.1. The natural frequency of the assembled pump and its supporting structure shall be at least 25 percent higher than the maximum pump excitation frequency. The pump shall operate within the vibration limits of the Hydraulic Institute

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23.5.2. The pumps shall be performance tested at the manufacturer's plant before shipment in accordance with Hydraulic Institute standards. Upon request, certified copies of the test curves shall be submitted to the engineer.

23.5.3. Each pump shall be hydrostatically tested at the manufacturer's plant before shipment in accordance with Hydraulic Institute standards. Upon request, certified copies of the test results shall be submitted to the engineer.

23.6 FIELD SERVICE

23.6.1. One (1) day of Field Service shall be provided by an authorized, factory trained representative of the Pump Manufacturer per unit purchased. Services shall include, but not necessarily be limited to, inspection of the completed installation to ensure that it has been performed in accordance with the manufacturer's instructions and recommendations, supervision of all field-testing and activation of the Manufacturer's Prescribed Warranty.

23.6.2. The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

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24.0 **LINE ITEM NO. 24 PUMP, HEAVY DUTY VERTICAL MOTORI**
Make: Chicago Yeoman
Model: No. Series 2111, OSC-10, 30 HP or City Approved Equal

24.1 **SUMMARY OF REQUIREMENT:**

24.1.1. This specification provides guidelines for design and manufacture of low and medium voltage vertical squirrel cage induction motors

24.1.2. Work governed by these specifications includes manufacture, testing, and delivery of equipment constructed in accordance with the requirements presented herein.

24.1.3. Items not addressed by these specifications include, but are not limited to:

24.1.3.1. Unloading and Installation

24.1.3.2. All External Connections

24.2. Codes and Standards

24.2.1. All equipment shall be fabricated, assembled and tested in accordance with the most current applicable standards as defined by the following institutions:

24.2.1.1. American National Standards Institute (ANSI)

24.2.1.2. Institute of Electrical and Electronic Engineers (IEEE)

24.2.1.3. National Electrical Manufacturer's Association (NEMA)

24.2.1.4. Anti-Friction Bearing Manufacturer's Association (AFMBA)

24.2.2. All materials and equipment shall be labeled or listed as being approved by the Underwriter's Laboratories (U.L.) whenever applicable.

24.2.2.1. Equipment offered as meeting the intent of the U.L. requirements may be acceptable subject to the approval of the purchaser.

24.3. Conditions of Service

24.3.1. Motors shall be suitable for continuous operation on a three-phase, 60 hertz system rated 460 volts. Motor Shall be 30-Horsepower and 875 RPM.

24.3.2. Motors shall be designed to operate at rated load in a maximum ambient temperature of 40°C at a maximum altitude of 1,000 meters.

24.3.3. The location of installation will be either indoors or outdoors as dictated by the specific provisions for each motor.

24.3.4. Motor Shall Be Furnished by the Yeoman's Chicago Corporation to Fit Existing Chicago Pump Series 2111, Model OSC-10, 30-Horsepower Pumps.

Design Requirements

24.4 **General**

24.4.1. Motors shall be capable of withstanding all normal forces which may be imposed upon them during the course of normal operation, including starting and normal stops.

24.4.2. Motors shall be suitable for across the line starting and shall be able to start and accelerate the connected load to full load speed with 90 percent of rated voltage at the motor terminals.

24.4.3. Motors shall be capable of continuous operation at full load and rated frequency with a voltage variation of ⌖10 percent.

24.4.4. Motors shall be capable of continuous operation at full load and rated voltage with a frequency variation of ⌖5 percent.

24.4.5. Motor starting current shall not exceed a value equal to 650 percent of the motor full load current.

24.4.6. Motor installations in hostile environments subject to dust, moisture and/or corrosive atmospheric conditions shall have all parts given protective treatment.

24.5 **Enclosure**

24.5.1. Motors shall be furnished with one of the following enclosure types based on the location of installation and the specific requirements for each motor.

24.5.1.1. Weather Protected, Type I (WP-I)

24.5.1.2. Weather Protected, Type II (WP-II)

24.5.1.3. Totally Enclosed, Fan Cooled (TEFC)

24.5.1.4. Totally Enclosed, Explosion proof (XP) for applicable Class, Group, Division, and Temperature Code.

24.5.2. Openings on all Weather Protected designs shall be covered with metal guard screens having a mesh size no greater than ½ inch square.

24.5.2.1. When specified, Weather Protected, Type II designs shall be furnished with removable, cleanable and reusable air filters over intake air openings.

24.5.3. Enclosures shall be of fabricated steel or cast iron construction in accordance with manufacturer's standard design. Canopy caps shall be of aluminum, cast iron or sheet metal and shall be easily removable for maintenance purposes.

24.5.4. Motors shall be furnished with drain openings and plugs.

24.6 **Stator Construction**

24.6.1. Stator laminations shall be of fully processed steel. Each lamination surface shall be given the necessary treatment to have core plate type C-5 insulation.

24.6.2. Stator windings for system voltages above 600 volts shall be form wound of rectangular copper magnet wire. Aluminum magnet wire in not acceptable. Individual coils shall be insulated with mica bearing tape prior to insertion. Coil extensions shall be blocked and braced sufficiently to minimize movement during normal starting and running conditions at full rated voltage.

24.6.3. Insulation

24.6.3.1. Insulation system shall be Class F

24.6.3.2. Insulation system shall receive a minimum of two vacuum pressure impregnation treatments using a 100 percent solids epoxy resin for form wound coils. Others shall receive similar treatments of 100 percent solids polyester resin.

24.6.3.3. When specified, a completely sealed insulation system shall be supplied. This system shall be capable of passing the NEMA MG 1-20.48 water immersion test.

24.6.4. Temperature rise shall not exceed the limits defined by NEMA for Class B insulation systems while operating at nameplate horsepower, frequency and voltage.

24.6.4.1. In the case of a particular rating where a Class F temperature rise is required, motors shall be furnished with Class F or better insulation.

24.7 **Rotor Construction**

24.7.1. Rotors shall be of cast or fabricated aluminum in accordance with manufacturer's standard design.

24.8 **Bearings**

24.8.1. Bearings supplied shall be of type and size sufficient to satisfy thrust loading requirements for each motor in accordance with manufacturer's standard design. Bearings shall be rated for an in-service B-10 life of 8,800 hours.

24.8.2. Thrust Bearings

24.8.2.1 Motors shall be designed and constructed with thrust bearings on top to allow inspection and/or replacement without requiring complete disassembly of motor.

24.8.3. Guide bearings or bearing assemblies shall be provided with sufficient means for preventing the leakage of lubricant or entrance of foreign matter along the shaft.

24.8.4. Lubrication

24.8.4.1. Thrust bearings shall be oil lubricated and contained in an oil reservoir with oil sight level gauge and oil fill and drain openings with plugs.

24.8.4.2. Deep-groove ball bearings furnished as thrust bearings for normal thrust motors shall be grease lubricated. When furnished as guide bearings for high thrust units, they shall be oil lubricated.

24.8.4.3. Grease lubricated bearings shall be furnished with provisions for in-service positive lubrication. A drain shall be provided to guard against over lubrication.

24.9 **Noise Level**

24.9.1. Sound pressure levels shall be measured according to IEEE 85 and shall not exceed 90 decibels as measured on the A-Weighted Scale at a distance of five (5) feet from any motor surface under no load free field conditions. Special noise levels may be required when specified.

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24.10 **Nameplates**

24.10.1. Motor nameplates shall be of stainless steel and shall be securely fastened to the motor frame with pins of a like material.

24.10.2. The following information shall be contained on the motor nameplate as a minimum:

24.10.2.1. Rated Horsepower
24.10.2.2. Full Load Speed
24.10.2.3. Frequency
24.10.2.4. NEMA KVA Code and Design Letter (when applicable)
24.10.2.5. Rated Voltage
24.10.2.6. Manufacturer's Serial Number
24.10.2.7. Service Factor
24.10.2.8. Insulation Class
24.10.2.9. Maximum Ambient
24.10.2.10. Full Load Current at Nameplate Voltage
24.10.2.11. Frame Size Designation

24.11 **Terminal Boxes**

24.11.1. Terminal boxes shall be of fabricated steel or cast iron construction to be compatible with the motor enclosure specified and when possible, shall be diagonally split and capable of rotation in 90° increments. Boxes not suitable for rotations must be capable of top entry.

24.11.2. The area in which the main terminal box is connected with the motor frame shall be fully gasketed in order to prevent entrance of foreign matter into the motor and to provide support for the stator leads where they pass through the motor frame.

24.11.3. A properly sized grounding terminal shall be mounted in the main terminal box.

24.11.4. The main terminal box shall be sufficiently oversized to allow stress cone terminations of shielded power cables and to allow the mounting of any surge capacitors, lightning arrestors, or current transformers when specified.

24.12 **Leads**

24.12.1. Main motor leads shall have EPDM or equal type jackets and shall be permanently tagged for identification.

24.12.2. The relationship between lead markings and the direction of rotation shall be indicated on a separate motor nameplate.

Accessories

24.13 Space Heaters

24.13.1. Motors shall be furnished with space heaters to provide sufficient wattage to maintain the internal temperature of the motor at a level approximately 10°C above the ambient temperature while the motor is not in operation.

24.13.2. Space heaters shall be of the silicone rubber strip type attached to the stator end turns. When specified, leads shall be brought out to an auxiliary terminal box.

24.13.3. Space heaters shall be rated for operation on a single phase, 60 hertz, 120 volt system.

24.14 **Protective Devices**

24.14.1. When specified, stator winding protection shall be provided consisting of one or more of the following systems:

24.14.1.1. One (1) positive temperature co-efficient (PTC) thermistor temperature sensor embedded in each phase of the stator winding and corresponding solid state electronic control.

24.14.1.2. Three (3) bi-metallic thermostats of the automatic reset type, with normally closed contacts, mounted one per phase. Each thermostat shall be furnished with leads suitable for connection to the control circuit.

24.14.2. When specified, surge protection shall be provided in the form of surge capacitors and lightning arrestors mounted, one (1) per phase in the main terminal box.

Testing

24.15 Motor shall be given a complete initial test in accordance with IEEE 112 Method B and shall include the following items:

- 24.15.1. Current Balance
- 24.15.2. High Potential Test
- 24.15.3. Vibration Test
- 24.15.4. Winding Resistance
- 24.15.5. Locked Rotor Current
- 24.15.6. No Load Running Current
- 24.15.7. Full Load Heat Run
- 24.15.8. Full Load Percent Slip
- 24.15.9. Efficiency at 100, 75 and 50 percent Load
- 24.15.10. Power Factor at 100, 75 and 50 percent Load
- 24.15.11. Noise test shall be performed in accordance with IEEE standard 85.
- 24.15.12. When specified, water immersion test shall be performed in accordance with NEMA MG 1-20.48.
- 24.15.13. Five (5) copies of certified test reports shall be submitted to the purchaser upon completion of all required tests.
- 24.15.14. The purchaser reserves the right to witness any or all of the tests specified to be performed. Prices for this shall be included as a separate item in the seller's quotation.

Submittal Data

24.16 Required with Proposal

- 24.16.1. Preliminary Dimension Print and Frame Size
- 24.16.2. Approximate Motor Weight
- 24.16.3. Complete Motor Nameplate Information
- 24.16.4. Motor Performance Data, including the following:
  - 24.16.4.1. Guaranteed minimum efficiency at 100, 75 and 50 percent of full load
  - 24.16.4.2. Guaranteed minimum power factor at 100, 75 and 50 percent of full load.
  - 24.16.4.3. Locked Rotor Current
  - 24.16.4.4. Full Load Current
  - 24.16.4.5. Starting Torque
  - 24.16.4.6. Full Load Torque
  - 24.16.4.7. Breakdown Torque
- 24.16.5. Complete Description of Testing Facilities
- 24.16.6. Jobsite Storage Requirements
- 24.16.7. Required within Six (6) Weeks of Purchase Order Award
- 24.16.8. Certified Dimension Prints
- 24.16.9. Recommended Spare Parts List, Priced
- 24.16.10. Required with Motor upon Shipment
- 24.16.11. Operation and Maintenance Manual
- 24.16.12. Connection Diagrams
- 24.16.13. Test Reports as Specified

Acceptable Manufacturers

24.17 Motors shall be provided by the Yeoman's Chicago Corporation and be Capable of Direct Mounting to the Series 2111, Model OSC-10 Vertical Pump.

25.0 **LINE ITEM NO. 25 PUMP, HEAVY DUTY WASTING PUMP**
Make: Chicago Yeoman
Model: No. LMC4 VPM or City Approved Equal

25.1 **SUMMARY OF REQUIREMENT:**

25.1.1. The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection.

The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

25.1.2. EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement for the Yeomans Wasting Pumps model LMC4 as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

25.1.3. INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

25.1.4. GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. The supplier shall be required to provide the wasting pumps and all parts required for the Yeomans Wasting Pumps model LMC4. The supplier shall include and match the current mount which is a horizontal base mount. The wasting pumps shall be rated for wastewater applications. All bidders must have demonstrated the unit they are bidding prior to bid date.

25.1.5. Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

25.1.6. Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

25.2 DESIGN REQUIREMENTS

RATED DUTY	300 GPM @ 39.4' TDH @ 1750 RPM
IMPELLER DIAMETER	7.125"
ELECTRIC DRIVE MOTOR	7.5 HP
DISCHARGE PRESSURE	15.5 PSI
MOTOR SPEED	1750 RPM

PART TWO - PRODUCTS

25.3 PUMP

25.3.1. The output shall be 400 GPM @ 35.0' TDH @ 875 RPM
25.3.2. Impeller diameter shall be 12.625'
25.3.3. The inlet and outlet size shall be 4-inch suction and discharge
25.3.4. Pump shall have dual mechanical seal
25.3.5. Pump shall have hardened 420 stainless steel wear rings

25.4 MOTOR

25.4.1. Motor speed shall be 875 RPM
25.4.2. Motor shall be 7.5 HP
25.4.3. Motor shall be electric with a 1.15 service factor
25.4.4. Motor shall have a totally enclosed fan cooled

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PART THREE - EXECUTION

25.5 DELIVERY

25.5.1. Entire assembled unit shall be delivered at COH's Cullen Maintenance Facility at 7440 Cullen, Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

25.5.2. The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

25.5.3. The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

25.5.4. Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

25.6 TOOLS AND SPARE PARTS

25.6.1 (4) Operations and Maintenance manuals.

25.7 WARRANTY

25.7.1. The manufacturer shall furnish the following to the owner:

25.7.2. Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up, which-ever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

26.0 **LINE ITEM NO. 26 PUMP, HEAVY DUTY BOOSTER PUMP**
Make: PACO
Model: No. KP 2930958030001 or City Approved Equal

26.1 SUMMARY OF REQUIREMENT:
Furnish, as described in these specifications, a Paco model KP double suction horizontal split case centrifugal pump (s), or equal, designed to deliver the scheduled flow rate (in GPM), the specified total dynamic head (in feet), at the scheduled efficiency and scheduled speed (RPM). OPTION: (The pumps shall also be NSF-50 and NSF-61 certified.) **378 GPM, 90.5 TDH, 3545 RPM.**

26.2 To insure cavitation-free operation, each pump's NPSH requirement must be low enough to permit stable, continuous operation at 120% or greater of best efficiency point.

26.3 Casing:
Pumps shall have the casing divided on the horizontal centerline. The casing halves shall be accurately machined, bolted and doweled together. A non-asbestos type gasket material shall be furnished between the casing halves. The casing material shall be close-grained cast iron with a minimum tensile strength of 35,000 P.S.I. Removal of the upper casing half and bearing housings shall permit removal of the complete rotating assembly without disturbing piping connections. Pumps shall be provided with removable bearing housings which will permit inspection and/or replacement of the mechanical seals, shaft sleeves, and bearings without removing the rotating assembly or top casing half. Pumps with 4 inch or larger discharge flanges shall be of the double volute design.

26.3.1 Casings shall be designed for scheduled working pressure and shall be hydrostatically tested at 150% of the maximum working pressure under which the pump could operate at design speed. Suction and discharge flanges shall be drilled to ANSI Standards and be machined flat face. Pumps shall be fitted with (lead-free bronze) (cast iron) renewable case wear rings indexed with a dowel pin for fixed positioning.

26.4 OPTIONS: case material-of-construction- Ductile Iron (A536), Bronze (B145), 316SS

26.5 Impeller:
The lead-free bronze impeller shall be an enclosed Francis vane type, double suction design, hydraulically and dynamically balanced. The impeller is to be securely mounted on the pump shaft, and attached with a steel key. The impeller shall be locked in position by threaded shaft sleeves. The impeller shall be trimmed to meet the specific hydraulic requirements. Impeller trim must be equal to or less than 90% of maximum diameter which will fit into the pump casing.

26.6 Shaft:
The pump shaft shall be made of high tensile steel, precision ground to provide a true running rotating element.

26.7 Bearings:
The pump shaft shall be adequately supported by the pump bearings to limit the shaft deflection to 0.002 inches.

26.7.1 Bearings shall be ball type, grease lubricated and locked to the shaft with positive locks of ample size to withstand any axial thrust loads. Each bearing housing shall be bolted to the upper and lower casing halves for a full 360-degree support registered fit to insure positive alignment. Bearing shall provide a minimum life of 10 years when calculated at 50% of Best-Efficiency-Point for the scheduled pump.

26.8 Shaft Seals:

The pump manufacturer shall recommend the proper mechanical seal based on the pressure, temperature and liquid outlined on the equipment schedule. Mechanical seals, at a minimum, shall have ceramic stationary seats, carbon rotating seats, and Buna elastomers.

26.9 Shaft Sleeves:

Lead-free bronze shaft sleeves shall be firmly attached to the pump shaft through threading and locking means. Shaft sleeve design shall prevent corrosion and wear to the shaft.

26.10 Base, Coupling, and Guard:

The pumps shall be mounted on a (cast iron base with drain) or (steel base with drip pan) and directly connected through a heavy-duty flexible coupling to a horizontal motor as outlined in these specifications. The pump manufacturer shall provide an OSHA coupling guard, which shall be mounted between the pump and motor and attached firmly to the base.

26.11 Motors:

The motor shall be sized to operate continuously without exceeding the horsepower rating (**60 HP, 208-230/460 Volt, 148-134/67 Amp, 3560 RPM, 60Hz, TEFC, Ins. F, Frame 364 5TS)** regardless of the flow and head throughout the operating range of the "System Curve." Motors shall meet EPAC standards for efficiency as a minimum.

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33.0 **LINE ITEM NO. 33 PUMP, HEAVY DUTY**
Make: Vaughan
Model: No. S3G-065 or City Approved Equal

33.1 **SUMMARY OF REQUIREMENT:**
Requirements for providing a submersible scum pit pump at WCID#47 WWTP

33.2 The specifications herein state the minimum requirements of the *City/Municipality*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The City may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City/Municipality* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

33.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved substitute to S3GNRG-065 Vaughan Pump, 5 HP, 150 GPM @30ft. TDH pump as interpreted by the *City/Municipality*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require an explanation at each deviation or substitution.

33.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City/Municipality*. Based upon such inquiry, the *City/Municipality* may choose to issue an Addendum in accordance with Local Public Contract Laws.

33.5 GENERAL SPECIFICATIONS: Units described shall be new, unused and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years. (Include users list) Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding prior to bid date.

33.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City/Municipality*. The *City/Municipality* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

33.7 Bidders, on request of the *City/Municipality*, must be prepared to review their specifications with the *City/Municipality* and must do so, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City/Municipality*.

33.8 The submersible pump is to be used to pump waste solids at heavy consistency such as but not limited to the following paper products, plastics , diapers, heavy rags, grease, hair balls, and stringy materials.

33.9 Operating Flow (Required)	150 GPM 30feet TDH
33.10 Voltage	460 V
33.11 Motor HP and Speed	5 HP and 1750 RPM
33.12 Power Cable(s)	25 feet
33.13 Frequency	60 Hz
33.14 Discharge size	4 inch
33.15 PUMP TO BE INSTALLED SHALL REQUIRE NO STRUCTURE AND/OR NO PIPING MODIFICATION. PUMP MUST FIT EXISTING GUIDE RAIL SYSTEM.	

33.16 CASING and VOLUTE: Pump castings shall be ductile iron or better. Thickness and weight shall insure long life, accurate alignment and reliable operation. Volute shall be designed to be smooth and free of blowholes and imperfections. Volute shall be designed to ensure passage of waste solids.

33.17 IMPELLERS: The pump impeller shall be semi-open chopper type with smooth passage to pass waste solids at heavy consistency such as but not limited to the following paper products, plastics, diapers, heavy rags, grease, hair balls, and stringy materials. Impeller shall also be able to withstand solids, fibrous material, wastewater sludge and other material present in wastewater. The impeller shall be made of cast steel and have a minimum Rockwell C Hardness of 60. Impeller shall be designed to chop and macerate waste products mentioned above. Rotation of the impeller shall be secured via a shaft key or other locking mechanism. Impeller shall not extend beyond past the cutter bar.

33.18 CUTTER BAR: Cutter bar shall be single cast component recessed into pump bowl. Set clearance between the cutter bar and impeller shall be adjustable between .005 inch to .02" inch. Cutter bar shall be cast steel heat treated to a minimum 60 Rockwell C Hardness.

33.19 UPPER CUTTER and CUTTER NUT: The upper cut shall consist of no more than 2 cutting anvils to minimize the potential for binding. Cutter nut shall be used to affix the impeller to the shaft and to eliminate binding or wrapping if stringy materials at the pump inlet. The set clearance between the impeller and the upper cutter shall be adjustable to .010 inches or less. The upper cutter and cutter nut shall be replaceable, made of cast steel and shall have a minimum Rockwell C Hardness of 60.

33.20 BEARINGS AND SHAFT: Bearing housing shall be ductile iron. Bearings must be permanently lubricated and rated in accordance with Anti-Friction Bearing Manufacturers Association for a minimum L_{10} bearing life of 100,000 hours at the best efficiency point. Inboard bearing shall be suitable for radial loads. Outboard bearing shall be capable of taking axial load in either direction as well as radial load to counter the moment on the shaft. Shaft shall be closed coupled directly to the pump shaft is using a solid sleeve coupling.

33.21 MOTOR: The submersible motor shall be rated at 5 HP, 1750 RPM, 460 Volts, and 3 phase, with a 1.0 service factor and Class F insulation. Motor shall be supplied with 25 feet of power and control cables. The frequency of the motor shall be 60 hertz and winding shall be insulation class F or better. Motor must be designed specifically for submersible pump usage (water tight). Motor shall be non-overloading for the entire range of the operating curve within the name plate and shall be capable of no less than 10 evenly spaced starts per hour. Motor shall be rated for continuous-in-air operation.

33.22 SEAL: Each pump shall be provided with a tandem mechanical shaft seal system. The seal shall contain silicon-carbide faces .The upper seal set shall function as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal shall be exposed to the lubricant in the bearing housing with no exposure to the pumpage. Seals shall rest on a 316 stainless steel shaft sleeve with seal tension held by 3 set screws.

33.23 PROTECTION: Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped in the end of the coils of the stator winding .These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. The pump shall be equipped with moisture sensors in the oil filled seal chamber to indicate seal leakage. Surface material is to be sandblasted and finished coated with epoxy.

33.24 COOLING: Cooling shall be provided to allow pump to be cooled while pumpage level is at the top of volute. Motor shall be rated for continuous-in-air operation.

33.25 ENVIRONMENT: Pump, motor and cable shall be designed for continuous submersible use without loss of water tight integrity.

33.26 **DELIVERY**

33.26.1 Entire assembled unit shall be delivered at COH's Cullen Service Center, 7400 Cullen Blvd. Houston, Texas 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

33.26.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

33.26.3 The delivery company must coordinate with the appropriate City of Houston staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

33.26.4 Final Delivery details should also be coordinated with Mr. Nathan Figueroa, WWTP Maintenance, Operations Branch, 7440 Cullen, Houston, Texas 77051 (Phone # 713-301-6083).

33.27 TOOLS AND SPARE PARTS

33.27.1 2 Kellems Grips shall be provided

33.27.2 4 O&M (Operations and Maintenance manuals).

33.28 WARRANTY

33.28.1 The manufacturer shall provide the following to the owner:

33.28.2 One (1) year warranty from the date of final system acceptance.

33.28.3 Components failing to perform as specified by the engineer or City of Houston representative shall be replaced, repaired, or satisfactorily modified by the supplier without cost of parts or labor to the owner.
33.28.4 In the event of a warranty claim, the City will make the electrical disconnects at the site and will make the electrical reconnections at the site

33.29 MANUFACTURERS/VENDOR SERVICES

33.29.1 The manufacturer shall furnish the services of (a) competent factory representative(s) to do the following upon request:

33.29.2 Provide complete training and local service capability for a period of not less than one half day.

33.29.3 Be present during installation of pump. Inspect the system prior to delivery, supervise the City of Houston during start up and testing and certify the system has been properly furnished and is ready for operation.

33.29.4 Provide assistance to questions or follow-up training for the first 3 months after pump acceptance.

REVISED 05/08/15

34.0 **LINE ITEM NO. 34 PUMP, HEAVY DUTY**

Make: Vaughan

Model: No. S3L-080 or City Approved Equal

34.1 SUMMARY OF REQUIREMENT:

Requirements for providing a Submersible Chopper Pump for Scum Removal System for the Sims Bayou North WWTP.

34.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

34.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of the Submersible Chopper Pump as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

34.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

34.5 GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.

34.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

34.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

34.8 EQUIPMENT

Vaughan Chopper Pump Model S3L-080

34.9 Pump assembly shall be a wet well vertically mounted chopper pump capable of macerating and conditioning sewage and scum materials.

34.10 Pump shall be rated for wastewater applications

34.11 Pump performance rating shall be 100 gpm @ 45 ft. of TDH

34.12 Pump motor shall be 7.5 hp 460 V , 60 Hz, 1750 RPM, 1.0 SF, explosion proof (Class 1, Group D), continuous in air submersible motor with tandem mechanical seals, moisture sensors, internal thermostats and 50 ft of power cord manufactured by Baldor. Starts per hour per NEMA standards.

34.13 Casing shall be ductile iron with 3" 125 Lb., ANSI rated discharge flange

34.14 Impeller, cutter bar, upper cutter and cutter nut shall be heat treated to a minimum 60 Rockwell C hardness.

34.15 Seal(s) shall be mechanical, cartridge type with SC or TC faces and designed to ride on 316 stainless shaft sleeve. The seal flatness shall be tested using Helium light source and confirmed to be optically flat within to two Helium light bands ie. about 0.000011 inches times two.

34.16 Pump must fit the existing guide rail systems without modification and it shall be furnished with a 3" ductile iron guide rail sliding bracket that will fit the existing guide rail system without modification.

34.17 Cutter bar shall be a single cast component. The set clearance between the cutter and impeller shall be adjustable to .005" to .020".

34.18 The upper cutter shall be a replac3eable item and separate from the casing back plate. The upper cutter shall be heat treated to a minimum 60 Rockwell C hardness.

34.19 The pump stub shaft and impeller shall be supported by ball bearings and the shaft shall be constructed of heat treated steel with a minimum diameter of 1.5".

34.20 The bearing housing shall be constructed of ductile cast iron

34.21 The shaft's bidirectional thrust shall be carried by two back-to-back mounted single-row angular contact ball bearings. A secondary mechanical seal shall be employed to isolate the bearings from the pumped media. The secondary seal and thrust bearings shall be oil bath lubricated and rated at a minimum for 100,000 duty hours.

34.22 The pump shall come equipped with an automatic oiling and oil level monitoring system. The oil level monitoring reservoir will be mounted on the top of the wet well and supplied with a 50 ft. of connecting hose. The oil system shall have an automatic cut off switch to shut the pump in the event of a low oil event. A 150 ft. of cable hard wired to the automatic oil monitor cap shall be provided.

34.23 The submersible motor shall be close coupled directly to the pump shaft with a solid sleeve coupling, keyed at both the pump and motor. Slip clutches and shear pin connections between shaft and motor will not be considered. The submersible motor shall be rated at 7.5 HP, 1750 RPM, 460 Volts, 60 Hertz, 3 phase, with a 1.0 service factor and Class F insulation. Motor shall have tandem mechanical seals in oil bath and dual moisture sensing probes. The motor shall be rated for continuous-in-air operation and provided with 50 feet of motor power and control cable.

34.23 A stainless steel nameplate with the manufacturer's displaying the model name, serial number, and ratings/performance parameters is required.

34.24 **DELIVERY**

34.25.1 Entire assembled units shall be delivered to Cullen Service Center, 7440 Cullen Blvd., Houston, TX 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

34.25.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

34.25.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

Final Delivery details should also be coordinated with Gurdip Hyare, Managing Engineer 832-395-5459.

34.25 **TOOLS AND SPARE PARTS**

(4) Operations and Maintenance manuals.

34.26 WARRANTY

34.26.1 The manufacturer shall furnish the following to the owner:

34.27.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

34.27.3 In the event of a warranty claim, the City will make the electrical disconnects at the site and will make the electrical reconnections at the site

REVISED 05/08/15

35.0 **LINE ITEM NO. 35 PUMP, HEAVY DUTY**

Make: Vaughan

Model: No. S3G-065 or City Approved Equal

35.1 SUMMARY OF REQUIREMENT:

Requirements for providing a Submersible Chopper Pump model #S3L-079 for Sims South WWTP.

35.2 The specifications herein state the minimum requirements of the *City of Houston*. All bids must be regular in every respect. Unauthorized conditions, limitations, or provisions shall be cause for rejection. The CITY may consider as "irregular" or "non-responsive", any bid not prepared and submitted in accordance with the bid documents and specification, or any bid lacking sufficient technical literature to enable the *City of Houston* to make a reasonable determination of compliance to the specification. It shall be the bidder's responsibility to carefully examine each item of the specification, failure to offer a completed bid or failure to respond to each section of the technical specification (exception yes or no) will cause the proposal to be rejected without review as "non-responsive". All variances, exceptions, and/or deviations shall be fully described in the appropriate section; deceit in responding to the specification will be cause for rejection.

35.3 EQUIVALENT PRODUCT: Bids will be accepted for consideration on any make and model that is a city approved direct replacement of a Vaughan Submersible Chopper Pump model #S3G-065 as interpreted by the *City of Houston*. A blanket statement that equipment proposed will meet all requirements will not be sufficient to establish equivalence, but will require replay an explanation at each deviation or substitution.

35.4 INTERPRETATIONS: In order to be fair to all bidders, no oral interpretations will be given to any bidder as to the meaning of the specifications documents or any part thereof. Every request for each a consideration shall be made in writing to the *City of Houston*. Based upon such inquiry, the *City of Houston* may choose to issue an Addendum in accordance with Local Public Contract Laws.

35.5 GENERAL SPECIFICATIONS: The unit described shall be new and unused. Unit shall be of the latest design and in current production completely serviced, ready for work and shall include standard and optional equipment as specified herein. The unit shall be a direct replacement of existing equipment with no modifications to system or structure. All bidders must have demonstrated the unit they are bidding prior to the bid date.

35.6 Bidders must have a fully stocked parts and service facility within 50 miles of the *City of Houston*. The *City of Houston* shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

35.7 Bidders, on request of the *City of Houston*, must be prepared to review their specifications with the *City of Houston* and must, if requested. These services, if needed are considered as part of the bidder's proposal and will be provided without cost or obligation to the *City of Houston*.

35.8 **EQUIPMENT**

Vaughan Chopper Pump Model S3G-065

35.9 Pump assemble shall be a wet well vertically mounted chopper pump capable of macerating and conditioning sewage and scum materials.

35.10 Pump shall be rated for wastewater applications

35.11 Pump performance rating shall be 280 gpm @ 26 ft. of TDH

35.12 Pump motor shall be 5 hp, three phase, 460 V, 60 Hz, 1750 rpm, 1.0 SF, explosion proof (Class1, Group D). continuous in air submersible motor with tandem mechanical seals, moisture sensors, internal thermostats, and 50ft. of power cable, manufactured by Baldor.

35.13 Casing shall be ductile iron with 3" 125 Lb. ANSI rated discharge flange connection to match exiting field piping

35.14 Impeller, cutter bar, upper cutter and cutter nut shall be cast steel, heat treated to a minimum 60 Rockwell C hardness. The impeller shall be dynamically balanced.

35.15 Seal(s) shall be mechanical, cartridge type with silicon carbide faces, as manufactured by Vaughan.

35.16 Pump must fit the existing guide rail systems without modification and it shall be furnished with a 3" ductile iron guide rail sliding bracket that will fit the existing guide rail system without modification.

35.17 Bearings shall be, oil bath lubricated ball type and bearing housing shall be cast ductile iron.

35.18 The pump shaft and impeller shall be supported by ball bearings and the shaft shall be constructed of heat treated steel with a minimum diameter of 1.5".

35.19 The bearing housing shall be constructed of ductile cast iron

35.20 Shaft thrust shall be taken up by either a double row angular contact ball bearing or two back-to-back mounted single row angular contact ball bearings, which bear against a machined shoulder on one side and the seal sleeve on the other side. Overhang from the centerline of the lower thrust bearing to the seal faces shall be a maximum of 1.2". Shaft overhang exceeding 1.2 inches from center of lower thrust bearing to seal faces shall be considered unacceptable. A mechanical seal shall isolate the bearings from the pumped media at operating temperatures to 250 F.

35.21 The lower motor seal shall be exposed only to the lubricant in the bearing housing, with no exposure to the pumpage. Motor shall include two normally closed automatic resetting thermostats connected in series and imbedded in adjoining phases. Motor frame shall be cast iron, and all hardware and shaft shall be stainless steel. Pump designs where the lower motor mechanical seal is exposed to the pumpage, will allow for pumpage to contaminate the submersible motor in the event of a lower motor seal failure. Therefore, designs where the lower motor seal is exposed to the pumpage will not be allowed on this project.

35.22 Hard-Wired Automatic Oil Level Monitor: A clear PVC oil reservoir with float switch shall be mounted at the top of the wet well, with 50 feet of hose feeding down to the side of the bearing housing to detect oil level and shut off the motor in event of low oil level. A sensitive relay shall be included for mounting in the motor control panel. In addition, 150 feet of cable, hard-wired to the automatic oil monitor cap shall be provided by the pump manufacturer.

35.23 The submersible motor shall be close coupled directly to the pump shaft with a solid sleeve coupling, keyed at both the pump and motor. Slip clutches and shear pin connections between shaft and motor will not be considered.

35.24 A stainless steel nameplate with the manufacturer's displaying the model name, serial number, and ratings/performance parameters is required.

35.25 **DELIVERY**

35.25.1 Entire assembled units shall be delivered to Cullen Service Center, 7440 Cullen Blvd., Houston, TX 77033, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

35.25.2 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

35.25.3 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

35.25.4 Final Delivery details should also be coordinated with Gurdip Hyare (Phone # 832-395-5459).

35.26 **TOOLS AND SPARE PARTS**

(4) Operations and Maintenance manuals.

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35.27 WARRANTY

35.27.1 The manufacturer shall furnish the following to the owner:

35.27.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

35.27.3 In the event of a warranty claim, the City will make the electrical disconnects at the site and will make the electrical reconnections at the site

REVISED 05/08/15

36.0 **LINE ITEM NO. 36 PUMP, HEAVY DUTY**

Make: Vaughan

Model: No. SP4C-089 or City Approved Equal

36.1 **SUMMARY OF REQUIREMENT:**

Greenridge WWTP self-priming chopper pump shall be a centrifugal pump specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Materials shall be chopped/macerated and conditioned by the pump as an integral part of the pumping action. The pump must have demonstrated the ability to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications. Produces 300 GPM @ 20 FT. TDH

36.2 Housing: Shall include 125 lb. 4"flanged inlet and 4"discharge flanges, an oversized cleanout and mounting feet. The housing shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics.

36.3 Casing and Back Pull-Out Plate: The pump casing shall be of volute design, spiraling outward to the 125 lb. flanged centerline discharge. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of casing from inlet or discharge piping. Casing & back plate shall be ductile cast iron with all water passages to be smooth, and free of blowholes and imperfections for good flow characteristics. A pressure tap shall be included on or near the discharge flange. Back plate shall include a replaceable Rockwell C 60 steel cutter adjustable for 0.005-0.015" clearance to cut against the rotating impeller pump out vanes for removing fiber and debris. Casing shall be a separate parts component of the housing.

36.4 Impeller: Shall be 8.9" diameter semi-open type with pump out vanes to reduce seal area pressure. Chopping/maceration of materials shall be accomplished by the action of the cupped and sharpened leading edges of the impeller blades moving across the cutter bar at the intake openings, with a maximum set clearance between the impeller and cutter bar of 0.015-0.025" cold. Impeller shall be cast alloy steel heat treated to minimum Rockwell C 60 and dynamically balanced. The impeller shall be threaded to the shaft and shall have no axial adjustments and no set screws.

36.5 Cutter Nose: Designed to cut stringy materials and prevent binding using two opposing cutter edges that cut against the inside of the cutter bar fingers. The cutter nose shall be cast steel heat treated to minimum Rockwell C 60.

36.6 Cutter Bar: Shall be recessed into the pump bowl, and shall extend diametrically across entire pump suction opening. Cutter bar shall be alloy steel and heat treated to minimum 60 Rockwell C Hardness.

36.7 Upper Cutter: Shall be threaded into the back plate behind the impeller, designed to cut against the pump-out vanes and the impeller hub, reducing and removing stringy materials from the mechanical seal area. Upper cutter shall be cast steel and heat treated to minimum 60 Rockwell C Hardness.

36.8 Pump Shafting: Shall be heat treated alloy steel.

36.9 Bearings: Shall be oil bath lubricated with ISO Gr. 100 turbine oil and site glass indication. Shaft thrust in both directions shall be taken up by a double-row angular contact ball bearing. A single-row radial bearing shall also be provided. B10 bearing life shall be minimum 100,000 hours.

36.10 Back Pull-Out Bearing Housing: Shall be ductile cast iron, and machined with piloted bearing fits for concentricity of all components. Back pull-out design shall incorporate jacking bolts for accurate adjustment of impeller-to-cutter bar clearance, and shall allow removal of pump components without requiring disconnection of housing from inlet or discharge piping. Viton® double lip seals riding on a stainless steel shaft sleeve shall provide sealing at the drive end of the bearing housing.

36.11 Mechanical Seal: Mechanical seal shall be cartridge type with silicon carbide (or tungsten carbide) faces. Seal shall be positively driven by set screws. Elastomers shall be Viton. This cartridge seal shall be a preassembled, and pre-tested so that no seal settings or adjustments are required from the installer. Any springs used to push the seal faces together must be shielded from the fluid to be pumped. The cartridge shall also include a 17-4PH, heat-treated seal sleeve and a CF8M stainless steel seal gland.

36.12 Shaft Coupling: Bearing housing and motor stool design is to provide accurate, self-aligning mounting for a C-flanged electric motor. Pump and motor coupling shall be T.B. Woods Sureflex elastomeric type.

36.13 Optional Belt Drive: Adjustable brackets shall be used to support a side-mounted motor. Sheaves and belts shall be properly sized for horsepower ratings, and all guards are to be supplied with the belt drive system.

36.14 Stainless Steel Nameplates: Shall be attached to the pump and drive motor giving the manufacturer's model and serial number, rated capacity, head, speed and all pertinent data.

36.15 Motor Requirements: Drive motor shall be 5 HP, 1750 RPM, 230/460 volts, 3 phase, 60 hertz, C-flange mounted, TEFC enclosure. The motor shall be sized for non-overloading conditions. Degreased and coated with an acrylic urethane (except motor).

36.16 OPTIONAL ADDER Surface Preparation: SSPC-SP5 commercial sandblast, primed with 3 MDFT zinc-filled primer and finish coated with 3 MDFT epoxy (except Motor).

36.17 **DELIVERY**

36.17.1 Entire assembled units shall be delivered to Cullen Service Center, 7440 Cullen Blvd., Houston, TX 77051, with sufficient capabilities of delivery vehicle to suitably off-load the assembled unit.

36.17.1 The assembled unit shall be packaged to prevent any damage to the unit during travel and off-loading.

36.17.1 The delivery company must coordinate with the appropriate City of Houston Staff to ensure the unit is off-loaded safely in the appropriate place and manner desired by the City of Houston.

36.17.1 Final Delivery details should also be coordinated with Gurdip Hyare (Phone # 832-395-5459).

36.18 **TOOLS AND SPARE PARTS**

(4) Operations and Maintenance manuals.

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36.19 WARRANTY

36.19.1 The manufacturer shall furnish the following to the owner:

36.19.2 Unit shall be warranted against defects in materials and workmanship for a period of 18 months from shipment or 12 months from start-up whichever is less, and shall cover 100% of parts and labor for the unit. Should the manufacturer's warranty exceed these requirements; the manufacturer's warranty shall be in effect. Warranty work shall be completed without cost to the City. It shall begin within 7 days after notification of the equipment failure or faulty material and shall be completed within a reasonable time frame, but not greater than 90 days. **All freight charges to and from the vendor's repair facility shall be borne by the seller during the warranty period.**

36.19.3 In the event of a warranty claim, the City will make the electrical disconnects at the site and will make the electrical reconnections at the site